

ABSTRACT

The present invention provides a rotational magnetic gimbal with an integral magnetic bearing. Brushless DC motor technology provides electromagnetic suspension, using a single electromagnetic actuator to perform both the radial bearing and rotary torque (motoring) functions. An integrated motor and magnetic bearing consistent with the invention comprises a rotor comprising a plurality of permanent magnets and a stator comprising a plurality of independently controlled coil segments magnetically coupled to the permanent magnets. Embodiments may further comprise first and second radial position sensors, the first radial position sensor disposed in or adjacent to a clearance gap between the rotor and the stator for sensing the position of the rotor with respect to the stator along a first axis, and a second radial position sensor disposed in or adjacent to the clearance gap between the rotor and the stator for sensing the position of the rotor with respect to the stator along a second axis. In method form, a method for providing integral electromagnetic motor and bearing functions comprises sensing a first radial position of a rotor, the rotor comprising a plurality of permanent magnets, with respect to a stator along a first axis, the stator comprising a plurality of independently controlled coil segments magnetically coupled to the permanent magnets; and sensing a second radial position of the rotor with respect to the stator along a second axis; and delivering current to at least one coil segment, the amount of current based on at least one sensed position.